

Chapter 12 Written Work Solutions

$$\#40 a) \quad 2.7 \text{ mol C} \left(\frac{1 \text{ mol CS}_2}{5 \text{ mol C}} \right) = 0.54 \text{ mol CS}_2$$

$$\#41 a) \quad 3.60 \times 10^2 \text{ g CH}_3\text{OH} \left(\frac{1 \text{ mol CH}_3\text{OH}}{32 \text{ g}} \right) \left(\frac{1 \text{ mol CO}}{1 \text{ mol CH}_3\text{OH}} \right) \left(\frac{\cancel{1 \text{ mol}}}{\cancel{1 \text{ mol}}} \right) = 11.3 \text{ mol CO}$$

$$3.60 \times 10^2 \text{ g CH}_3\text{OH} \left(\frac{1 \text{ mol CH}_3\text{OH}}{32 \text{ g}} \right) \left(\frac{2 \text{ mol H}_2}{1 \text{ mol CH}_3\text{OH}} \right) = 22.5 \text{ mol H}_2$$

$$\#42 a) \quad 66.6 \text{ g NH}_3 \left(\frac{1 \text{ mol NH}_3}{17 \text{ g}} \right) \left(\frac{5 \text{ mol F}_2}{2 \text{ mol NH}_3} \right) \left(\frac{38 \text{ g F}_2}{1 \text{ mol F}_2} \right) = 372 \text{ g F}_2$$

$$b) \quad 4.65 \text{ g HF} \left(\frac{1 \text{ mol HF}}{20 \text{ g HF}} \right) \left(\frac{2 \text{ mol NH}_3}{6 \text{ mol HF}} \right) \left(\frac{17 \text{ g NH}_3}{1 \text{ mol NH}_3} \right) = 1.32 \text{ g NH}_3$$

$$c) \quad 225 \text{ g F}_2 \left(\frac{1 \text{ mol F}_2}{38 \text{ g F}_2} \right) \left(\frac{1 \text{ mol N}_2\text{F}_2}{5 \text{ mol F}_2} \right) \left(\frac{66 \text{ g N}_2\text{F}_2}{1 \text{ mol N}_2\text{F}_2} \right) = 78.2 \text{ g N}_2\text{F}_2$$

$$\#44 c) \quad 15.0 \text{ L NH}_3 \left(\frac{1 \text{ mol NH}_3}{22.4 \text{ L NH}_3} \right) \left(\frac{1 \text{ mol Li}_3\text{N}}{1 \text{ mol NH}_3} \right) \left(\frac{34.7 \text{ g}}{1 \text{ mol Li}_3\text{N}} \right) = 23.2 \text{ g Li}_3\text{N}$$

$$\#48 \quad 15.0 \text{ g Sb}_2\text{S}_3 \left(\frac{1 \text{ mol Sb}_2\text{S}_3}{339.9 \text{ g Sb}_2\text{S}_3} \right) \left(\frac{2 \text{ mol Sb}}{1 \text{ mol Sb}_2\text{S}_3} \right) \left(\frac{121.8 \text{ g Sb}}{1 \text{ mol Sb}} \right) = 10.8 \text{ g Sb}$$

$$\text{Sb} \frac{9.84 \text{ g}}{10.8 \text{ g}} \times 100 = 91\%$$

$$\#50 a) \quad 1.4 \text{ g HNO}_3 \left(\frac{1 \text{ mol HNO}_3}{39 \text{ g HNO}_3} \right) \left(\frac{4 \text{ mol Zn}}{10 \text{ mol HNO}_3} \right) \left(\frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol Zn}} \right) = 9.20 \times 10^{21} \text{ atoms}$$

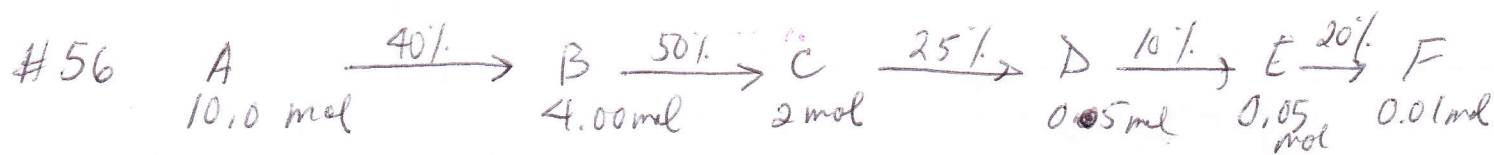
$$b) \quad 29.1 \text{ g NH}_4\text{NO}_3 \left(\frac{1 \text{ mol NH}_4\text{NO}_3}{80 \text{ g NH}_4\text{NO}_3} \right) \left(\frac{4 \text{ mol Zn}}{1 \text{ mol NH}_4\text{NO}_3} \right) \left(\frac{65.4 \text{ g Zn}}{1 \text{ mol Zn}} \right) = 95.1 \text{ g Zn}$$

$$\#52 a) \quad 50.0 \text{ g SiO}_2 \left(\frac{1 \text{ mol SiO}_2}{60.1 \text{ g}} \right) \left(\frac{1 \text{ mol SiC}}{1 \text{ mol SiO}_2} \right) \left(\frac{40.1 \text{ g SiC}}{1 \text{ mol SiC}} \right) = 33.4 \text{ g SiC}$$

$$b) \quad 50.0 \text{ g SiO}_2 \left(\frac{1 \text{ mol SiO}_2}{60.1 \text{ g SiO}_2} \right) \left(\frac{2 \text{ mol CO}}{1 \text{ mol SiO}_2} \right) \left(\frac{28 \text{ g CO}}{1 \text{ mol CO}} \right) = 46.6 \text{ g CO}$$

$$\frac{32.2 \text{ g}}{33.4 \text{ g}} \times 100 = 96\%$$

$$\#54 \quad 228g \text{ NH}_4\text{NO}_3 \left(\frac{1 \text{ mol NH}_4\text{NO}_3}{80g} \right) \left(\frac{7 \text{ moles of gas}}{2 \text{ mol NH}_4\text{NO}_3} \right) \left(\frac{22.4L}{1 \text{ mol gas}} \right) = 223L \text{ gas}$$



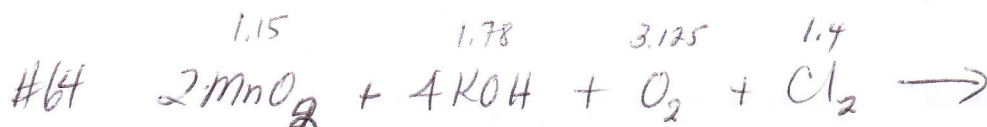
$$\#57 \quad 63/55 \times 100 = 115\% \quad \begin{array}{l} > \text{outside contamination} \\ > \text{unreacted reactant (incomplete rxn)} \end{array}$$

$$\#60 \quad 1250 \text{ Km} \left(\frac{1L \text{ Gas}}{9.2 \text{ Km}} \right) \left(\frac{1000 \text{ cm}^3}{1L} \right) \left(\frac{0.69g \text{ Gas}}{1 \text{ cm}^3} \right) \left(\frac{1 \text{ mol Gas}}{114g} \right) \left(\frac{25 \text{ mol O}_2}{2 \text{ mol Gas}} \right) \left(\frac{22.4L}{1 \text{ mol O}_2} \right) \left(\frac{1L \text{ Air}}{0.21L \text{ O}_2} \right) = 1.1 \times 10^6 L \text{ Air}$$

$$\#61 \quad (13 \text{ days}) \quad 1.0 \times 10^3 \text{ Kg Glucose} \left(\frac{1000g \text{ Glu}}{1 \text{ Kg Glu}} \right) \left(\frac{1 \text{ mol Glu}}{180g \text{ Glu}} \right) \left(\frac{2 \text{ mol Al}}{1 \text{ mol Glu}} \right) \left(\frac{5 \text{ hr}}{8 \text{ Kg Al}} \right) \left(\frac{4g \text{ Al}}{1 \text{ mole Al}} \right) \left(\frac{1 \text{ Kg}}{1000g} \right) \left(\frac{1 \text{ day}}{24 \text{ hr}} \right) = 13 \text{ days}$$

$$\#62 \quad 1004.0g \text{ CaCO}_3 \left(\frac{95g \text{ CaCO}_3}{100g \text{ sample}} \right) \left(\frac{1 \text{ mol CaCO}_3}{100.1g} \right) \left(\frac{1 \text{ mol CO}_2}{1 \text{ mol CaCO}_3} \right) \left(\frac{44g \text{ CO}_2}{1 \text{ mol CO}_2} \right) \left(\frac{1}{225L} \right) = 1.8633g/L$$

$$\#63 \quad 81.8g \text{ ~~CaCl}_2~~ \left(\frac{1 \text{ mol CaCl}_2}{111.1g \text{ CaCl}_2} \right) \left(\frac{1 \text{ mol CaCO}_3}{1 \text{ mol CaCl}_2} \right) \left(\frac{100.1g \text{ CaCO}_3}{1 \text{ mol CaCO}_3} \right) = \frac{73.7}{84.4} \times 100 = 87.3\% \text{ CaCO}_3$$



$$100.0g \text{ MnO}_2 \left(\frac{1 \text{ mole}}{86.9g} \right) = 1.15 \text{ mol MnO}_2$$

$$100.0g \text{ O}_2 \left(\frac{1 \text{ mol}}{32g} \right) = 3.125$$

$$100g \text{ KOH} \left(\frac{1 \text{ mol}}{56.1g} \right) = 1.78 \text{ mol KOH}$$

$$100.0g \text{ Cl}_2 \left(\frac{1 \text{ mol}}{70.0} \right) = 1.4$$

O₂ + Cl₂ are clearly excessive for MnO₂ + KOH

1	2	1.15	1
2	4	1.78	1.5
MnO ₂	KOH		

$$\#65 \ a) \ 454 \text{ g Fe}_2\text{O}_3 \left(\frac{1 \text{ mol Fe}_2\text{O}_3}{159.6 \text{ g Fe}_2\text{O}_3} \right) \left(\frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \right) \left(\frac{55.8 \text{ g Fe}}{1 \text{ mol Fe}} \right) = 317 \text{ g Fe}$$

$$b) \ 454 \text{ g Fe}_2\text{O}_3 \left(\frac{1 \text{ mol Fe}_2\text{O}_3}{159.6 \text{ g Fe}_2\text{O}_3} \right) \left(\frac{3 \text{ mol CO}_2}{1 \text{ mol Fe}_2\text{O}_3} \right) \left(\frac{44 \text{ g CO}_2}{1 \text{ mol CO}_2} \right) = 239 \text{ g CO}_2$$

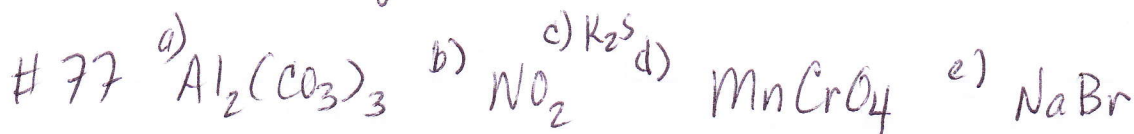
$$\#66. \ 20.0 \text{ g FeS}_2 \left(\frac{1 \text{ mol FeS}_2}{120 \text{ g}} \right) = 0.2 \text{ mol FeS}_2 \quad 16 \text{ g O}_2 \left(\frac{1 \text{ mol O}_2}{32 \text{ g}} \right) = 0.5 \text{ mol O}_2$$

$$\begin{array}{l} \text{From Equation} \quad \frac{4 \text{ FeS}_2}{11 \text{ O}_2} \quad \text{From Given} \quad \frac{0.2}{0.5} \\ = \frac{1 \text{ FeS}_2}{2.75 \text{ O}_2} \quad \frac{1 \text{ FeS}_2}{2.5 \text{ O}_2} \end{array}$$

O₂ is limiting

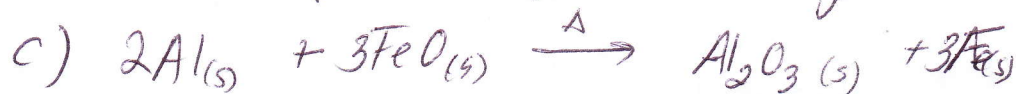
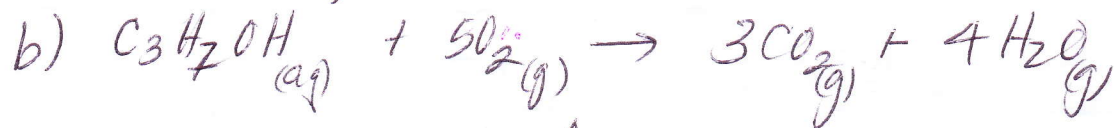
$$16 \text{ g O}_2 \left(\frac{1 \text{ mol O}_2}{32 \text{ g O}_2} \right) \left(\frac{8 \text{ mol SO}_2}{11 \text{ mol O}_2} \right) \left(\frac{2 \text{ mol SO}_3}{2 \text{ mol SO}_2} \right) \left(\frac{80.1 \text{ g}}{1 \text{ mol SO}_3} \right) = \boxed{29.1 \text{ g SO}_3}$$

- #76. a) Silicon Dioxide
b) Potassium Sulfate
c) Carbonic acid
d) Magnesium Sulfide



$$\#79 \ 147 \text{ g Beryl} \left(\frac{270 \text{ g Be}}{504 \text{ g Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}} \right) = 213 \text{ g Be}$$

$$\begin{array}{l} \#80 \ 26.7 \text{ g C} \left(\frac{1 \text{ mol}}{12 \text{ g}} \right) = 2.23 \text{ mol C} \\ 2.2 \text{ g H} \left(\frac{1 \text{ mol}}{1 \text{ g}} \right) = 2.2 \text{ mol H} \\ 7.1 \text{ g O} \left(\frac{1 \text{ mol}}{16 \text{ g}} \right) = 0.44 \text{ mol O} \end{array} \quad \begin{array}{l} \text{Empirical} \\ \text{CH}_2\text{O}_2 \\ \text{Molecular} \quad \frac{90}{45} = 2 \\ \text{C}_2\text{H}_4\text{O}_4 \end{array}$$



Pg 383 2-10 even

#2 $6.20\text{g P}_4 \left(\frac{1\text{mol P}_4}{124\text{g P}_4} \right) \left(\frac{6\text{mol F}_2}{1\text{mol P}_4} \right) \left(\frac{38\text{g}}{1\text{mol F}_2} \right) = \text{A}$



Statement 1

Statement 2

#6

True

True, but doesn't necessarily explain Statement

#8

True

True

#10

False

False

+